

Evaluation of Methyl Iodide and Carbon Disulfide as Alternatives to Methyl Bromide for the Control of Stored Product Insects

Kostjukovsky, M., Carmi, Y., Atsmi, S. and Shaaya, E.
Dept. of Stored Products, The Volcani Center, Bet Dagan, Israel

As the fate of methyl bromide is doubtful and a massive phase out of its use expected in the future, there is an urgent need to search for suitable alternatives.

Two fumigants were tested for this purpose: carbon disulfide (CS₂) and methyl iodide (CH₃I). The first is a known fumigant, which was not widely used and the second fumigant has not been studied enough for the control of stored product insects.

The tests were carried out in three ways:

1. space fumigation in 3.5 l fumigation chambers.
2. fumigation in 600 ml glass chambers filled to 70% by volume with wheat.
3. fumigation in glass columns 10 cm in diameter x 120 cm in height filled to 70% by wheat.

Test insects were: adults of *Rhyzopertha dominica*, *Oryzaephilus surinamensis*, *Sitophilus oryzae* and *Tribolium castaneum*, and also larvae and pupae of *Plodia interpunctella*, *Tribolium castaneum* and *Trogoderma granarium*.

Results. In space fumigation CH₃I was very effective against all insect stages. A low concentration of 3.5-5 µl/l for 3 h exposure was enough to obtain 100% mortality of the test insects. CS₂ was less effective and needed a concentration of 6-10 µl/l for 24 h to achieve a total mortality of all stages of the tested insects.

The toxicity of the two fumigants to the test insects varied as follows: for CH₃I, adults of *T. castaneum* were the most resistant while those of *S. oryzae* were the most susceptible. The larvae- of *P. interpunctella* were the most susceptible while those of *T. granarium* were the most resistant. The pupae of *T. granarium* were not affected at all by CH₃I at the concentrations tested.

For CS₂, adults of *T. castaneum* and larvae of *T. castaneum* and *T. granarium* were the most resistant, while adults of *R. dominica* were the most susceptible to this fumigant.

In the experiments with wheat in glass chambers CH₃I showed higher activity than CS₂, too. The concentrations of CH₃I and exposure times needed to obtain a total mortality of the test insects were similar to those in the space tests, whereas

with CS₂, higher concentrations of 10-20 µl/l for 2-5 days were needed to achieve a total mortality. These vast differences between the two fumigants were probably due to higher sorption rate Of CS₂ compared to the sorption of CH₃I in wheat.

In the experiments with glass columns, CH₃I was again showed higher activity than CS₂ when circulation was used. In gravity application CS₂ penetrated better but it needed higher concentrations and exposure times to achieve a total mortality of the test insects.

Conclusion. Of the two fumigants tested, CH₃I was found to be more toxic to stored product insects and less sorptive in wheat than CS₂. We are planning in future experiments to use these compounds in a mixture with carbon dioxide (CO₂), to study possible synergistic effect of the two fumigants and CO₂, and to examine its influence on the penetration capacity of the fumigants and also to reduce the risk of flammability Of CS₂.

The activity of these two fumigants will be discussed in relation to bromide and phosphine.